

4.7. Solar Studies

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Our Institute is the International Solar Station № 34501 carrying out monitoring of solar activity in the chromospheric line H_{α} . Data on solar flares, active prominences and eruptive events are obtained, processed, and sent to World Data Center WDC Boulder Co, USA. From 01.01.2001 to 12.31.2007 data about 395 solar flares and 356 eruptive events have been obtained.

Kharkiv spectroheliograph has been equipped with a CCD-camera. This provides for higher angular resolution, especially in IR. After the modernization, the spectroheliograph allows us to record the images of the Sun in any spectral line of the 350 – 1100 nm range in 2 minutes. Figure 32 shows an image of the Sun in He I line (10830 angstrom) obtained with the spectroheliograph, 2007.08.25. Figure 33 shows comparison of images of the Sun in He I line acquired in our Institute (2007.08.17, UT 11^h09^m) and National Astronomical Observatory (Kitt Peak) (2007.08.17, UT 18^h07^m).

We support several web-sites presenting regularly updated solar activity data. One of them (<http://www.astron.kharkov.ua/khassm/>) presents solar images at different wavelengths, which have been obtained at our observational station. Web-site “Space Weather” (<http://sw.astron.kharkov.ua/>) uses space data and after our processing represents in real time information about Earth space environment (X-flares, proton events, and Kp that is the geomagnetic index) in friendly graphic form.

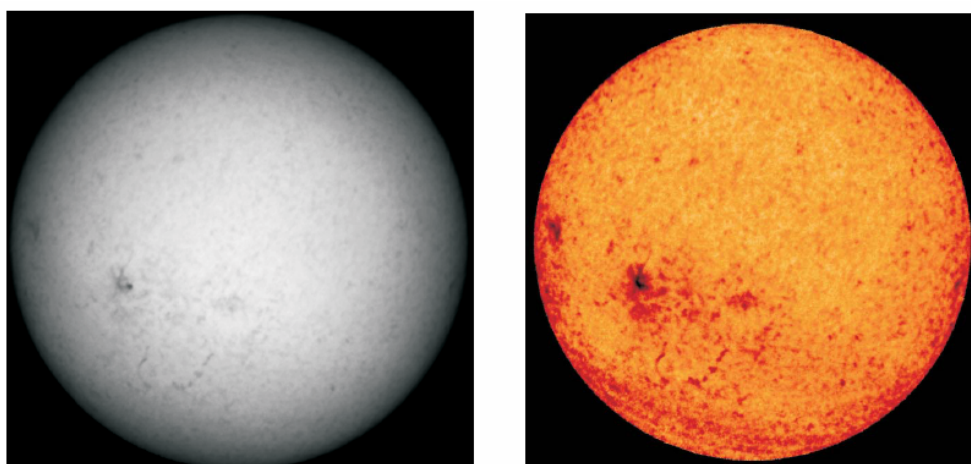


Figure 32. Image of the Sun in He I (10830 angstrom) line, 2007.08.25. Left: before darkening compensation, right: after darkening compensation

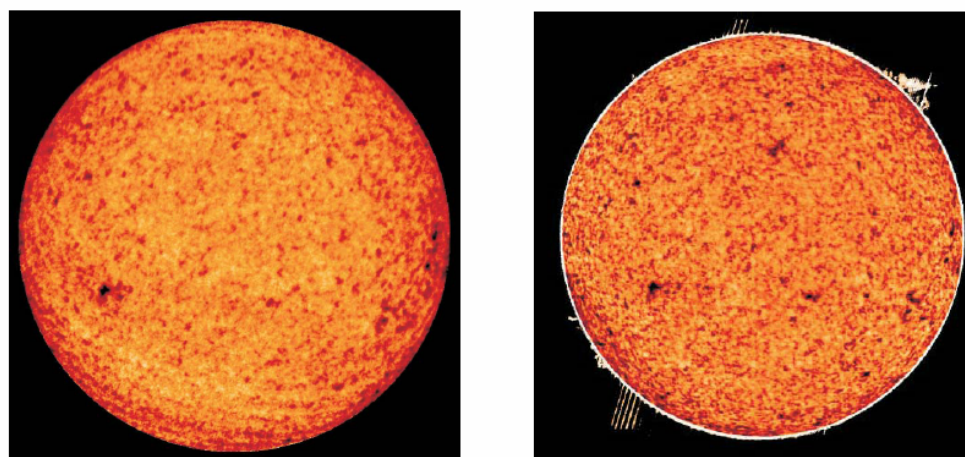


Figure 33. Image of the Sun in He I (10830 angstrom) line, 2007.08.17. Left: Institute of Astronomy, Kharkiv National University, UT 11h09m; Right: NAO (Kitt Peak) UT 18h07m

We carry out solar cyclic researching using data on X-ray flares. Daily flare indexes *XFI* have been calculated for time period from 01.01.1975 to 31.12.2007. Using the *XFI* index, it has been demonstrated that the maximum of the current 23-rd solar cycle was smoother than for the previous cycle. It has been found that full energy of all solar flares in

the 22-nd cycle was in 2.5 times greater than energy of the 23-rd cycle. We have found difference between the 22 and 23 solar cycles in power spectrum of these periods.

Maps of distribution of surface brightness of the chromosphere in D_3 line of helium along latitude as a function of altitude have been studied for three solar eclipses. It has been found that heterogeneity of distributions of the lines intensity has the typical size of about the supergranulation size. It has been shown that height distribution of the surface brightness of chromosphere in the D_3 HeI line has one or two maxima at the altitude ~ 200 km (lower) and 1500 – 2000 km (basic). The lower maximum is explained by coronal X-ray radiation with wavelengths less than 6 nm that causes helium ionization. It has been shown that such a coronal emission may reach of photospheric altitude. The results found from eclipse of March 29, 2006 data confirms our assumption that lower maximum of the altitude distribution of helium is absent during solar activity minimum.

Quasi-synchronism of X-ray bursts in the structures of solar corona in the Mg XII 0.84 nm line from the SPIRIT/CORONAS-F data was studied. It has been revealed that the sympathetic bursts are observed in some pairs of AR fragments. The probable values of magnetic field strength are 65 – 410 Gs if the related sympathetic bursts are caused by propagation of MHD waves in the coronal loops.

During 3 years in different seasons, studies of atmospheric vibrations of the solar limb at the Chuguev Observational Station were carried out using a specially developed device. It has been shown that mean-square amplitude of image tremble is within 1" for 70% cases of the researching period. In summer, during stable anticyclone, the amplitude is within 0.9", and in the morning and evening times is about 0.5" - 0.6". It allows us to carry out high-quality observations of the Sun at the observational station using new spectroeliograph which is constructed at Institute for Radiophysics and electronics of National Academy of Sciences for our Institute.